



CORROSION RESISTANCE OF FRP FANS

INTRODUCTION

Process applications involve a wide variety of corrosive gas streams. Selecting the best materials of construction for air handling equipment can be difficult. This Engineering Letter provides information about the corrosion resistance of the resins used to manufacture standard **nyb** FRP fans.

GAS STREAM TYPES

Fumes are the dry vapors evolved from acids, solvents, etc. An example is the dry acid vapor scavenged from a process using acid. As a generalization, fumes are not as corrosive as aerosols.

Aerosols are suspensions of liquids or solids in a gas stream. For the purpose of this discussion, aerosols are considered as being wet. Water as fog is an example of an aerosol. Another example is the mist of acid present in air scavenged from a process where acid is being used as a spray wash. As a generalization for the purpose of estimating corrosiveness, aerosols in fan-driven systems can be considered as being dilute concentrations of the chemicals composing the aerosols.

An example of the distinction between fumes and aerosols is a system where sulfuric acid fumes are collected by hoods and scrubbed. The dry fumes entering the scrubber could be quite concentrated but have a relatively mild corrosive effect on the hood and duct material. On the other hand, the wet gas down stream from the scrubber could be quite dilute but more corrosive because of the scrubber's converting the fumes to an aerosol.

CORROSION-RESISTANCE GUIDE

The corrosion-resistance guide presented in this Engineering Letter is adapted from the literature published by the manufacturers of the resins used in the standard construction of **nyb** FRP fans. The guide provides data for aerosols being handled in fan-system gas streams. Data for chemicals that are potentially damaging as aerosols are marked "fumes only".

Where the user is unsure of the nature of the chemicals involved, or of the corrosive effect of the combination of chemicals involved, it is advisable to insert resin test coupons, as well as coupons of possible alternate materials of construction, into the gas stream for observation.

TYPES OF RESIN USED BY **nyb**

All polyesters and vinyl esters are corrosion resistant to some degree. The resins used by **nyb** are at the highly resistant end of the scale of corrosion resistance. (The opposite end from general-purpose resins, sometimes called "boat resins".)

Standard FRP construction consists of Hetron® 92FR, a good chemical-duty grade of polyester made by Ashland Chemical Company, for the housing and all non-rotating parts. Wheels are made of Derakane® 510A40, a top-quality chemical-duty vinyl ester made by Dow Chemical Company. (See separate Engineering Letter for a full description of **nyb** resins.)

All-vinyl ester airstream construction consists of all FRP parts being made from Derakane 510A40.

SURFACE VEIL

Standard **nyb** construction does not include the use of surface veil. Years of service prove this construction to be cost-effective and functionally successful.

However, the general approach to the design of most FRP chemical-process equipment, such as storage tanks, is to use surface veil. Therefore, the ASTM standard specification for FRP Fans and Blowers, D4167, calls for a layer of surface veil on the inner surface of the fan housing. If required, **nyb** will construct a fan with synthetic veil on the housing airstream surfaces to meet ASTM D4167.

Synthetic veil such as Nexus®, a polyester veil made by Precision Fabrics Group, Inc. and used exclusively by **nyb**, is advantageous in helping to build a relatively thick surface layer (approximately 10 mils) that protects the glass structure from attack by chemicals that are particularly aggressive toward glass. Where the use of synthetic veil is advisable, the corrosion-resistance guide is so noted. For more information on surface veil and its uses, refer to Engineering Letter 21.

CUSTOMER RESPONSIBILITY

nyb will provide quality FRP construction using either of the above resin types as specified by the customer. This Engineering Letter and any discussions between **nyb** representatives and the customer should not be construed as a warranty of material suitability for a particular application. The system designer should have sufficient knowledge of, or experience with, the application to select the appropriate resin or alternate material.

**CORROSION-RESISTANCE GUIDE TO FUME AND AEROSOL CONTAMINATED AIR
FOR nyb FRP CONSTRUCTION AND ASSORTED METALS**

Corrosive Agent	FRP			Metals				
	Standard FRP Construction	All-vinyl Ester Airstream	Carbon Steel	Aluminum	304 Stainless Steel	316 Stainless Steel	Monel	Hastelloy C-276
Acetaldehyde	R*	R*	N	R*	R	R	R*	R
Acetic Acid	R	R	N	R*	R*	R	R*	R
Acetic Acid, Glacia	N	N	N	R*	R*	R	R	R
Acetic: HCl: H ₂ O	R	R	N	N	N	N	R*	R*
Acetic Acid: HCl	R	R	N	N	N	N	R*	R*
Acetic: H ₂ O ₂	R	R	N	N	N	N	R*	R*
Acetic Anhydride	N	N	N	R	R*	R	R*	R
Acetone	N	R	R	R	R	R	R	R
Acetyl Chloride	N	R	N	N	R	R	R*	R
Acetylene	T	T	R*	R	R	R	R*	R*
Acrylic Acid	R	R	N	T	R	R	T	N
Acrylonitrile	N	R ³	R*	R*	R	R	R*	R*
Aerosol [®] , Wetting Agent	R	R	T	T	T	T	T	T
Almond Oil	R	R	R	R	R	R	R*	R*
Aluminum Acetate†	T	R	T	R*	R	R	R	R
Aluminum Chloride (dry)†	T	R	N	R*	N	R*	R*	R
Aluminum Fluoride†	RV	RV	N	R*	N	N	R*	R*
Aluminum Sulfate†	R	R	N	N	R	R	R*	R
Ammonia	R*	R	R*	R	R	R	R*	R*
Ammonium Carbonate†	R*	R	R*	R	R	R	R	R
Ammonium Chloride†	R	R	N	N	R	R	R*	T
Ammonium Hydroxide	R*V	RV	N	R*	R	R	N	T
Ammonium Nitrate†	R	R	N	N	R	R	R*	T
Ammonium Persulfate	R	R	N	R*	R	R	N	T
Ammonium Sulfate†	R	R	N	R*	R*	R*	R*	R*
Ammonium Sulfite	R	R	N	N	R*	R	R*	R
Amyl Acetate	R	R	N	R	R	R	R	R
Amyl Alcoho	R	R	R*	R*	R	R	R	R
Aniline	N	N	N	N	R	R	R*	R*
Aniline Sulfate	R	R	N	N	T	T	T	T
Anthracene Oi	R	R	T	T	T	T	T	T
Antimony Pentachloride	R	R	N	N	N	N	T	T
Antimony Trichloride†	R	R	N	N	N	N	T	T
Aqua Regia (HNC ₃ - HCl)	R	R	N	N	N	N	T	N
Arsenious Acid	R	R	N	N	R	R	T	R*
Barium Carbonate†	R	R	R*	N	R	R	T	R*
Barium Chloride†	R	R	N	N	R	R	RT	R*
Barium Hydroxide†	N	R	N	N	R*	R*	R*	R*
Beer	R	R	N	R	R	R*	R	R
Benzaldehyde	N	R*	N	R*	R*		T	R
Benzene	N	N	N	R*	R	R	R*	R*
Benzene, Sulfonic Acid	R	R	N	N	R*	R*	T	R*
Benzoic Acid	R	R	N	R*	R	R	R	R*
Benzoyl Chloride	N	R	N	T	R	R	T	T
Benzyl Alcoho	N	N	R*	R*	R	R	R	R*
Benzyl Chloride	N	R*	N	N	N	R*	R*	N
Boric Acid	R	R	N	R*	R	R	R*	R
Bromine, Dry Gas	R	R	N	N	N	N	T	R
Bromine, Moist Gas	R	R	N	N	N	N	N	R
Butane	T	T	R	R*	R	R	R	R*
Butyl Acetate	R*	R*	N	T	R	R	T	T
Butyl Alcoho	T	R	R*	R*	R	R	T	R*
Butyl Hypochlorite	X	X	T	T	T	T	T	T
Butylene Glyco	R	R	T	T	T	T	T	T
Butylene Oxide	N	N	T	T	T	T	T	T
Butyric Acid	R	R	T	R*	R	R	R*	R
Calcium Chlorate†	R	R	T	T	R	R	R*	R
Calcium Chloride†	R	R	N	R*	R*	R*	R	R

Corrosive Agent	FRP			Metals				
	Standard FRP Construction	All-vinyl Ester Airstream	Carbon Steel	Aluminum	304 Stainless Steel	316 Stainless Steel	Monel	Hastelloy C-276
Calcium Hydroxide	TV	RV	N	N	R*	R	R	R
Calcium Hypochlorite	X	X	N	N	N	R*	N	R
Calcium Sulfate†	R	R	N	N	R*	R*	R*	R*
Carbon Dioxide	R	R	R*	R	R	R	R*	R
Carbon Disulfide Vapo	R*	R*	R*	R	R*	R*	R*	R*
Carbon Tetrachloride	R	R	R*	N	R*	R	R	R
Cascade Solutior	R	R	R*	R*	R	R	T	R*
Chlorine Dioxide	T	R	N	R*	N	N	T	R
Chlorine Gas, Dry	RV	RV	R*	N	R*	R*	R	R
Chlorine Gas, Wet	RV	RV	N	N	N	N	N	R
Chloroacetic Acid	R*	R*	N	N	R*	R	R*	R
Chlorobenzene	N	N	R*	R*	R*	R*	R*	R
Chlorofluorocarbor	R	R	T	T	T	T	T	T
Chloroform	N	R*	N	R*	R	R	R	R
Chlorosulfonic Acid	N	N	R*	R*	N	N	R*	R
Chlorotoluene	N	R*	N	N	N	R*	R*	N
Chrome-Plating Batt	R*	R	N	N	R*	R*	N	R
Chromic Acid	R	R	N	N	R*	R	R*	R
Chromic Acid + Sulfuric	R	R	N	N	N	R*	R*	R
Citric Acid	R	R	N	R*	R	R	R*	R
Cooling Towers	R	R	T	T	T	T	T	T
Copper Chloride	R	R	N	N	N	N	N	R*
Copper Cyanide	R	R	N	N	R	R	N	R
Copper Nitrate	R	R	N	N	R	R	N	R
Copper Oxychloride	R	R	N	N	N	N	N	R*
Copper Sulfate†	R	R	N	N	R	R	N	R
Cyclohexane	R	R	R*	R*	R*	R*	R	R*
DDT, Insecticide Solutior	R	R	T	T	T	T	T	T
Dichlorobenzene	N	N	R*	R*	R*	R*	R*	R
Dichloroethylene	N	N	N	R*	R*	R*	R*	R*
Dichlorophenoxyacetic	R*	R	T	T	T	T	T	T
Dichloropropane	N	N	T	T	T	T	T	T
Dichlorotoluene	N	R	N	N	N	T	T	N
Diesel Fue	R	R	R	R	R	R	R*	R*
Diethyl Ether	N	N	R*	R*	R*	R*	R*	R*
Diethyl Glyco	R	R	R*	R*	R*	R*	R*	R*
Diethyl Ketone	N	N	T	T	T	T	T	T
Diethyl Maleate: Water	R	R	T	T	T	T	T	T
Diethylbenzene	T	R	N	T	N	T	T	T
Diisobutyl Ketone	N	N	T	T	T	T	T	T
Diisobutylene	T	R	T	T	T	T	T	T
Dimethyl Sulfide	N	N	T	T	T	T	T	T
Dimethyl Sulfoxide	R*	R*	T	T	T	T	T	T
Dimethylformamide	R*	R*	N	R	R*	R*	R*	T
Dimethylamine	R*	R*	T	R	R	R	T	T
Dipropylene Glyco	R	R	T	T	T	T	T	T
Divinyl Benzene	T	R	T	T	T	T	T	T
Dodecene	N	R	T	T	T	T	T	T
Dodecylbenzenesulfoni	R	R	T	T	T	T	T	T
Acid: H ₂ SO ₄ : H ₂ O: oil								
Esters, Fatty Acid	R	R	N	R	R*	R*	R*	R
Ethanol Chloride	N	R	T	T	T	T	T	T
Ether	R*	R*	R*	R*	R	R	R*	R*
Ethyl Acetate	N	R	R*	R*	R	R	R*	R*
Ethyl Alcoho	R	R	R*	R*	R	R	R*	R
Ethyl Acrylate	N	N	N	R*	R*	R*	R*	R
Ethyl Benzene	N	R	N	R*	N	R*	R*	R
Ethyl Chloride	R*	R*	R*	R*	R	R	R*	R*

† These compounds are normally solids; considered here as being water solutions.

R* - Recommended for fumes only. Care must be taken to prevent formation of condensate on wheel or in housing

T - Test data not available

V - Surface Veil required

D - Double layer of surface veil required

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	Standard FRP Construction	All-vinyl Ester Airstream	Carbon Steel	Aluminum	304 Stainless Steel	316 Stainless Steel	Monel	Hastelloy C-276
Ethyl Ether	N	R*	R*	R*	R*	R*	R*	R*
Ethylene Chlorohydrin	R	R	R*	R*	R*	R*	R*	R*
Ethylenediamine Tetra Acetic Acid	N	R■	T	T	T	T	T	T
Ethylene Dibromide	N	R*	N	R*	R*	R*	R*	R*
Ethylene Dichloride	N	N	R*	R*	R	R	R	R*
Ethylene Glyco	R	R	R*	R*	R*	R*	R*	R
Ethylene Oxide	N	N	R*	R*	R*	R*	R*	R
Fatty Acids	R	R	N	R	R*	R*	R*	R
Ferric Chloride†	R	R	N	N	N	N	N	R*
Ferric Nitrate†	R	R	N	N	R	R	N	R*
Ferric Sulfate†	R	R	N	N	R*	R	R*	R
Ferrous Chloride†	R	R	N	N	N	N	N	R*
Ferrous Sulfate†	R	R	N	R*	R*	R*	R*	R*
Flue Gas, (wet)	R	R	N	R*	T	R*	T	R
Fluoboric Acid	RV	RV	R*	N	R*	R	R*	R
Fluorine Gas	N	RD■	N	R	R	R	R	R*
Fluosilicic Acid†	RV	RV	N	N	N	N	R*	R*
Fluosulfonic Acid†	R*	R	T	T	T	T	T	T
Formaldehyde	R	R	R*	R*	R	R	R	R*
Formic Acid	R	R	N	N	R*	R	R*	R
Fuel Oil	R	R	R*	R*	R	R	R*	R
Fungicides	R	R	T	T	T	T	T	T
Fungus, 95% Relative Humidity	R■	R	T	T	T	T	T	T
Furfural	R*■	R*■	R*	R	R*	R*	R*	R*
Gasoline	R	R	R	R	R	R	R	R
Gasoline, Aviator	R	R	R	R	R	R	R	R
Glycerine	R	R	R*	R	R	R	R	R
Glycolic Acid	R	R	N	R*	R*	R*	R*	R*
Heptane	R	R	R*	R	R	R	R*	R
Hexane	R	R	R*	R	R	R	R*	R
Hexachlorocyclopentadiene	R	R	T	T	T	T	T	T
Hexachloroethane	N	N	T	T	T	T	T	T
Hexamethylenetetramine	R	R	T	T	T	T	T	T
Hydrazine	N	N	T	T	R	R	T	T
Hydrochloric Acid Fumes	RD	RD	N	N	N	N	R*	R
Hydrochloric Acid + Free C ₂	RD	RD	N	N	N	N	R*	R
Hydrocyanic Acid	R	R	N	R	R*	R	R	R
Hydrofluoric Acid	R*D	RD■	N	N	N	N	R	R*
Hydrogen	R	R	R	R	R	R	R	R
Hydrogen Bromide	R	R	N	N	N	N	N	R*
Hydrogen Chloride	R	R	N	N	N	N	R*	R
Hydrogen Fluoride	R*V	RV■	N	N	N	N	R	R*
Hydrogen Peroxide	R	R	N	R	R	R	R*	R
Hydrogen Sulfide	R	R	R*	R*	R*	R*	R*	R
Hydroxyacetic Acid	R	R	N	R*	R*	R*	R*	R*
Hypochlorous Acid	R	R	N	N	N	N	N	R*
Insecticides	R	R	T	T	T	T	T	T
Iodine	R*	R	N	R	N	N	R*	R
Iron Perchlorate†	R	R	T	T	T	T	T	T
Isobutyl Alcohol	T	R	T	T	T	T	T	T
Isopropyl Alcohol	T	R■	R*	R*	R	R	R*	R
Isopropyl Amine	T	R	T	T	T	T	T	T
Kerosene	R	R	R*	R	R	R	R*	R*
Lactic Acid	R	R	N	R*	R*	R	N	R*
Lead Acetate†	R	R	N	N	R*	R*	R*	R*
Leather Dyeing & Finishing	R	R	T	R	R	R	T	R*
Linseed Oil	R	R	R*	R*	R	R	R*	R*
Lithium Carbonate	N	RV	T	T	T	T	T	T
Lithium Chloride†	R	R	R*	N	R	R	R	R
Lithium Hydroxide	N	RV	N	N	R*	R*	R*	R*
Lithium Hypochlorite	X	X	T	T	T	T	T	T
Magnesium Carbonate†	R	R	N	R*	R	R	R*	R*
Magnesium Chloride†	R	R	N	N	N	N	R*	R*
Magnesium Sulfate†	R	R	R*	R*	R*	R*	R	R*
Malathion	R	R	T	T	T	T	T	T
Maleic Acid	R	R	N	R*	R*	R*	R*	R*
Mercapto Acetic Acid	N	N	T	T	T	T	T	T
Mercuric Chloride†	R	R	N	N	N	N	N	R*
Mercurous Chloride†	R	R	N	N	N	N	N	R*
Mercury	R	R	R*	N	R	R	R*	R
Methacrylic Acid	R	R	T	T	R	R	T	N
Methyl Alcohol	R*	R*	R*	R*	R	R	R*	R
Methyl Bromide	R*	R*	R*	N	R*	R*	T	T
Methyl Chloride	R■	R	N	N	R	R	R*	R*
Methyl Ethyl Ketone	N	N	R*	R*	R	R	R*	R*
Methylene Chloride	N	N	R*	R*	R*	R*	R*	R
Mineral Oil	R	R	R*	R*	R	R	R	R*
Monochloroacetic Acid	R*	R*	N	N	R	R	T	R
Monochlorobenzene	N	N	R*	R*	R*	R*	R*	R*
Monoethanolamine	N	N	R*	R*	R	R	R*	R*
Naphtha	R	R	R*	R	R	R	R*	R*
Naphthalene	R	R	R*	R	R	R	R*	R*
Nickel Chloride†	R	R	N	N	R*	R	R*	R
Nickel Nitrate†	R	R	N	N	R	R	R*	R*
Nickel Sulfate†	R	R	N	N	R*	R*	R*	R*
Nitric, Red Fuming	N	R*	N	R	R	R	N	R*
Nitric Acid	R	R	N	N	R	R	N	R
Nitrobenzene	N	N	R*	R*	R*	R*	R*	R*
Nitrogen	R	R	R	R	R	R	R	R
p-Nitrotoluene Sulfonic Acid	R*	R	T	T	T	T	T	T
Nitrous Acid	R■	R	N	N	R*	R	N	T
Nut Oil, Ground	R	R	R*	R	R	R	R*	R*
Oakite Stripper SA®	R	R	T	T	T	T	T	T
Oleic Acid	R	R	R*	R	R	R	R	R
Oleoparathion	R	R	T	T	T	T	T	T
Oleum	N	N	R*	R*	R*	R*	N	R
Olive Oil	R	R	R	R	R	R	R*	R
Oxalic Acid†	R	R	N	R*	R	R	R*	R*
Oxidizing Gases	R	R	T	T	T	T	T	T
Ozone	T	R*	N	R*	R*	R*	R*	T
Palmitic Acid	R	R	N	R*	R*	R	R*	R*
Parathion, Wei	R	R	T	T	T	T	T	T
Perchloroethylene	R*	R	R*	R*	R	R	R	R*
Perchloric Acid	R■	R*	N	N	N	N	N	R*
Petroleum Ether	R	R	R*	R	R	R	R	R
Phenol	N	N	R*	R	R	R	R	R*
Phenol, Sulfonic Acid	N	N	T	T	R	R	T	T
Phosphate Salts†	R	R	N	R*	R	R	R*	R
Phosphoric Acid	R	R	N	N	R*	R	R*	R
Phosphorous Acid	R	R	R*	R*	R	R	R	R
Phosphorous Oxichloride	N	T	N	R*	N	N	R*	R*
Phosphorous Trichloride	N	N	R*	N	R	R	T	R*
Phthalic Acid	R	R	N	R*	R	R	R*	R*
Phthalic Anhydride	R	R	R*	R	R	R	R	R

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Picric Acid in Alchoho	R*	R*	N	N	R*	R*	N	R*
Polychlorocyclohexane Sulfid	R	R	T	T	T	T	T	T
Polyvinyl Acetate Emulsion:	R	R	N	T	R	R	T	T
Polyvinyl Alchoho	R	R	N	T	T	T	T	T
Polyvinylidene Chlorid	R	R	T	T	T	T	T	T
Potassium Bicarbonate†	R*V	RV	R*	N	R*	R*	R*	R*
Potassium Carbonate†	R*V	RV	R*	N	R*	R*	R*	R*
Potassium Chloride†	R	R	R*	N	R*	R	R	R
Potassium Cyanide	N	R*■	R*	N	R	R	R*	R*
Potassium Dichromate†	R	R	R*	R	R	R	R*	R*
Potassium Ferrocyanide†	R	R	R*	R*	R*	R*	R*	R*
Potassium Hydroxide	N	RD■	R*	N	R	R	R	R
Potassium Nitrate†	R	R	N	R*	R*	R*	R*	R*
Potassium Permanganate†	R	R	R*	R	R	R	N	R
Potassium Persulfate†	R	R	T	T	T	R*	T	R
Potassium Sulfate†	R	R	R*	R*	R	R	R	R
Propionic Acid	R■	R	T	T	T	R*	N	R
Propionyl Chloride	N	T	T	T	T	T	T	T
Propylene Glyco	R	R	R*	R*	R*	R*	R*	R*
Pulp and Paper Mil Blow Down Gases	RV■	RV	T	T	T	T	T	T
Pyridine	N	N	R*	R*	R*	R*	R*	R*
Rayon Spin Bath	R	R	N	T	N	R*	T	R*
Selenious Acic	T	R	N	N	T	T	N	T
Sewage Treatmen	R	R	N	R*	R*	R*	T	R*
Silver Nitrate†	R	R	N	N	R	R	N	R*
Sodium Acetate†	R	R	N	R	R*	R*	R*	R
Sodium Benzoate†	R	R	T	R	T	T	R*	R*
Sodium Bicarbonate†	RV	RV	N	R*	R	R	R	R
Sodium Bisulfate†	R	R	N	N	R*	R*	R*	R*
Sodium Bisulfite†	R	R	N	N	R*	R*	R*	R*
Sodium Borate†	R	R	N	R*	R*	R*	R*	R
Sodium Bromide†	R	R	N	N	R*	R*	R*	R*
Sodium Carbonate†	RV	RV	R*	N	R	R	R*	R
Sodium Chloride†	R	R	N	N	R*	R	R	R
Sodium Chloride, pH 10.5 Cl ₂ Sat.	R*	R	N	N	N	N	N	R
Sodium Chlorite†	R	R	N	T	R*	R	T	R*
Sodium Cyanide	T	R	R*	N	R	R	N	R*
Sodium Dichromate	R	R	R*	R*	R*	R*	T	R
Sodium Ferricyanide†	R	R	T	R	R*	R*	R*	R
Sodium Hydroxide†	RV■	RV	R*	N	R	R	R*	R*
Sodium Hypochlorite†	X	X	N	N	N	N	N	R*
Sodium Nitrate†	R	R	R*	R	R	R	R*	R*
Sodium Sulfate†	R	R	R*	R	R	R	R	R
Sodium Sulfide†	R■	R	R*	N	R*	R	R*	R*
Sodium Sulfite†	R	R	R*	R*	R	R	R*	R*
Sodium Xylenesulfonat	R	R	T	T	T	T	T	T
Stannic Chloride†	R	R	N	N	N	N	N	R*
Stannous Fluoride	N	RV■	N	N	N	N	T	T
Hydrofluoric Acid	R	R	N	R*	R*	R	R*	R
Stearic Acid	R	R	N	R*	R*	R	R*	R
Styrene	R*	R*	R*	R	R	R	T	N

Corrosive Agent	FRP			Metals				
	Standard FRP Construction	All-Vinyl Ester Airstream	Carbon Steel	Aluminum	304 Stainless Steel	316 Stainless Steel	Monel	Hastelloy C-276
Sulfamic Acid	R*	R*	N	N	T	R*	T	T
Sulfated Detergents	R	R	N	N	T	T	T	T
Sulfate Liquors	R	R	N	N	R*	R*	R*	R*
Sulfite Liquors	R	R	N	N	R*	R*	N	R
Sulfur, Wetable, Fungicide	R	R	N	R	R	R	R	R
Sulfur Dichloride	R	R	N	N	N	R*	N	R*
Sulfur Dioxide	R*	R	R*	R*	R*	R*	R*	R*
Sulfur Trioxide	R■	R	R*	R*	R*	R*	R*	R*
Sulfuric Acid	R	R	N	N	N	R*	R*	R*
Sulfuric Acid: Phosphoric Acid	R	R	N	N	N	R*	R*	R*
Sulfuric: Nitric Acids	R	R	N	N	N	R*	N	R*
Sulfurous Acid	R*	R*	N	R*	N	R*	N	R*
Sulfuryl Chloride	N	R	T	R*	T	T	R*	R
Sweet Oil	R	R	R	R	R	R	R*	R
Tannic Acid	R	R	N	N	R*	R*	R*	R*
Tar Camphor	R	R	R*	R	R	R	R*	R*
Tartaric Acid	R	R	N	R*	R	R	R*	R*
Tetrachloroethane	T	R*	R*	N	R*	R	T	R
Tetrachloropyridine	T	R■	T	T	T	T	T	T
Tetrapotassium Pyrophosphate†	R	R	T	T	T	T	T	T
Thionyl Chloride	N	N	N	N	N	N	R*	T
Tin, Molten, Fumes	R	R	N	N	N	N	T	R
Toluene	R	R	R	R	R	R	R	R
Toluene Sulfonic Acic	R*	R	T	T	T	T	T	T
Tolyl Chloride	N	RV	T	T	T	T	T	T
Trichloroacetaldehyd	N	R	T	T	T	T	T	T
Trichloroacetic Acic	R	R	N	N	N	N	R*	R*
Trichloroethane	N	R■	T	N	R*	R*	T	R
Trichloroethylene	N	R*	R*	R*	R*	R*	R	R
Trichloromonofluoromethan	TV	RV■	T	T	T	T	T	T
Trichloropheno	N	T	T	T	T	T	T	T
Triethanolamin	T	R	R*	R*	R*	R*	R*	R*
Trimethylene Chlorobromid	N	N	T	T	T	T	T	T
Trisodium Phosphate†	R	R	R*	N	R*	R*	R*	R
Turpentine	N	R	R*	R*	R	R	R	R*
Urea	T	R	R*	R*	R*	R*	R*	R*
Urotropine	R	R	T	T	T	T	T	T
Vinegar	R	R	N	R*	R	R	R*	R
Vinyl Chloride	N	N	T	R*	R*	R*	T	R*
Vinyl Toluene	T	R ³	T	T	T	T	T	T
Waste, Organic, H ₂ O, HCl, Cl ₂ Vapors	RV■	RV■	N	N	N	N	N	R
Water, Deionized	R	R	N	R*	N	R*	T	R*
Water, Demineralizec	R	R	N	R*	R	R	T	R*
Water, Distilled	R	R	N	N	R*	R*	N	R
Water, Sea	R	R	N	R*	R*	R*	R*	R
Water, Steam Condensate	R	R	R*	R*	R	R	R*	R
Xylene	N	R*	R*	R	R	R	R*	R
Zinc Chloride†	R	R	N	N	N	R*	R*	R*
Zinc Hydrosulfite†	R	R	N	N	R	R	T	T

† These compounds are normally solids; considered here as being water solutions. R - Recommended ■ - 120°F. maximum
R* - Recommended for fumes only. Care must be taken to prevent formation of condensate on wheel or in housing N - Not recommended
T - Test data not available V - Surface Veil required D - Double layer of surface veil required X - Consult New York Blower
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